TITLE: INDEXING VIRTUAL ATTRIBUTES IN A DIRECTORY SERVER SYSTEM
Inventor(s): Karine Excoffier, Robert Byrne and Gilles Bellaton
USSN: 10/616,081   Attorney Docket #: SUN-P7646

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CPU
11

EPROM
12

RAM
13

14

15

16

NET. HARD.
INTERFACE
21

10

20

FIGURE 1

TITLE: INDEXING VIRTUAL ATTRIBUTES IN A DIRECTORY SERVER SYSTEM
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LDAP CLIENT
18

LDAP | SERVER
17

17.1   **17. (n-1)**   **17.n**

FIGURE 2

TITLE: INDEXING VIRTUAL ATTRIBUTES IN A DIRECTORY SERVER SYSTEM
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DIRECTORY SERVER
30

SCHEMA
32

USER-ORIENTED
ENTRIES
310

CONFIGURATION
ENTRIES
311

ADMINISTRATIVE
ENTRIES
312

31

FIGURE 3

TITLE: INDEXING VIRTUAL ATTRIBUTES IN A DIRECTORY SERVER SYSTEM
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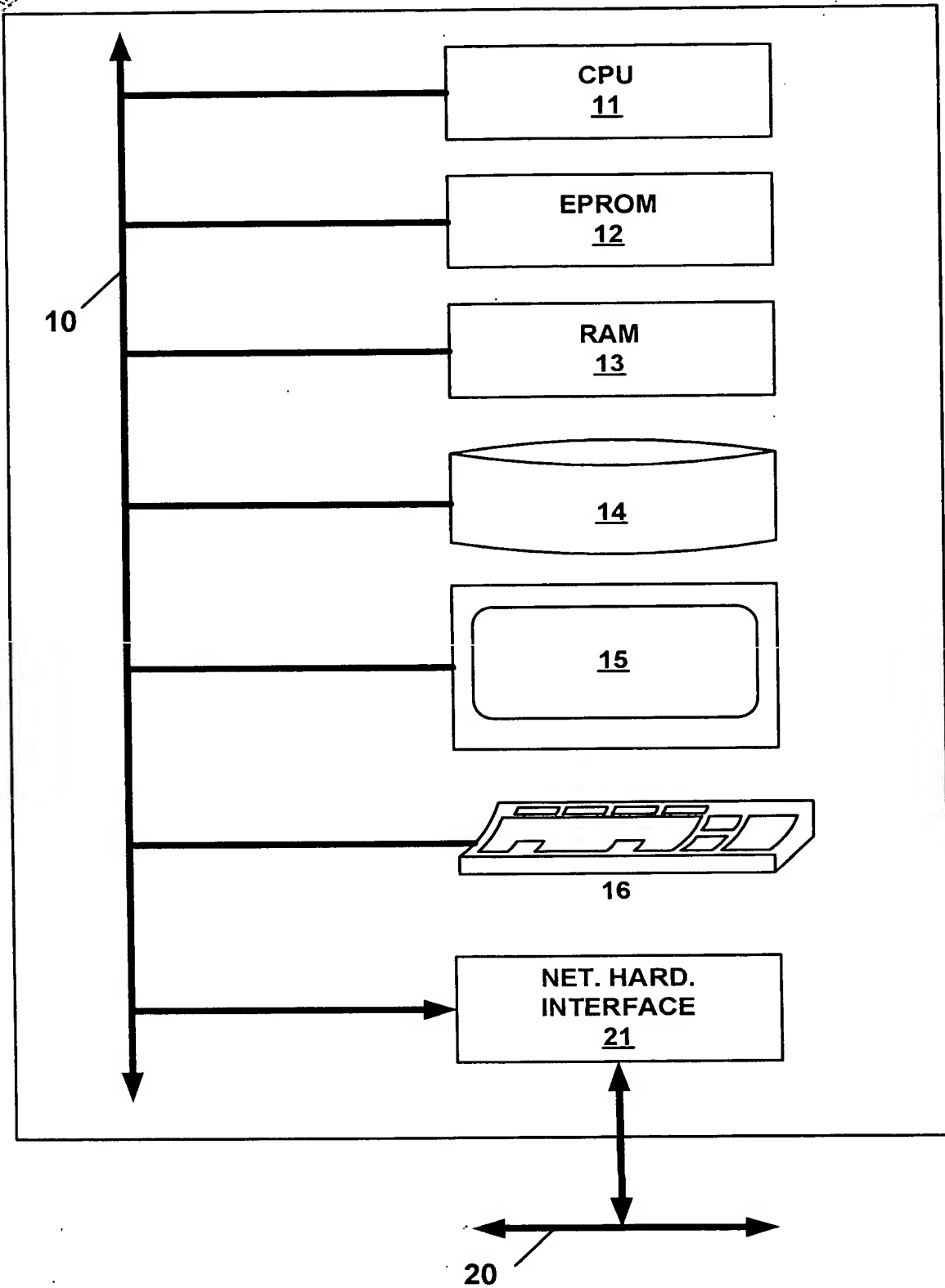
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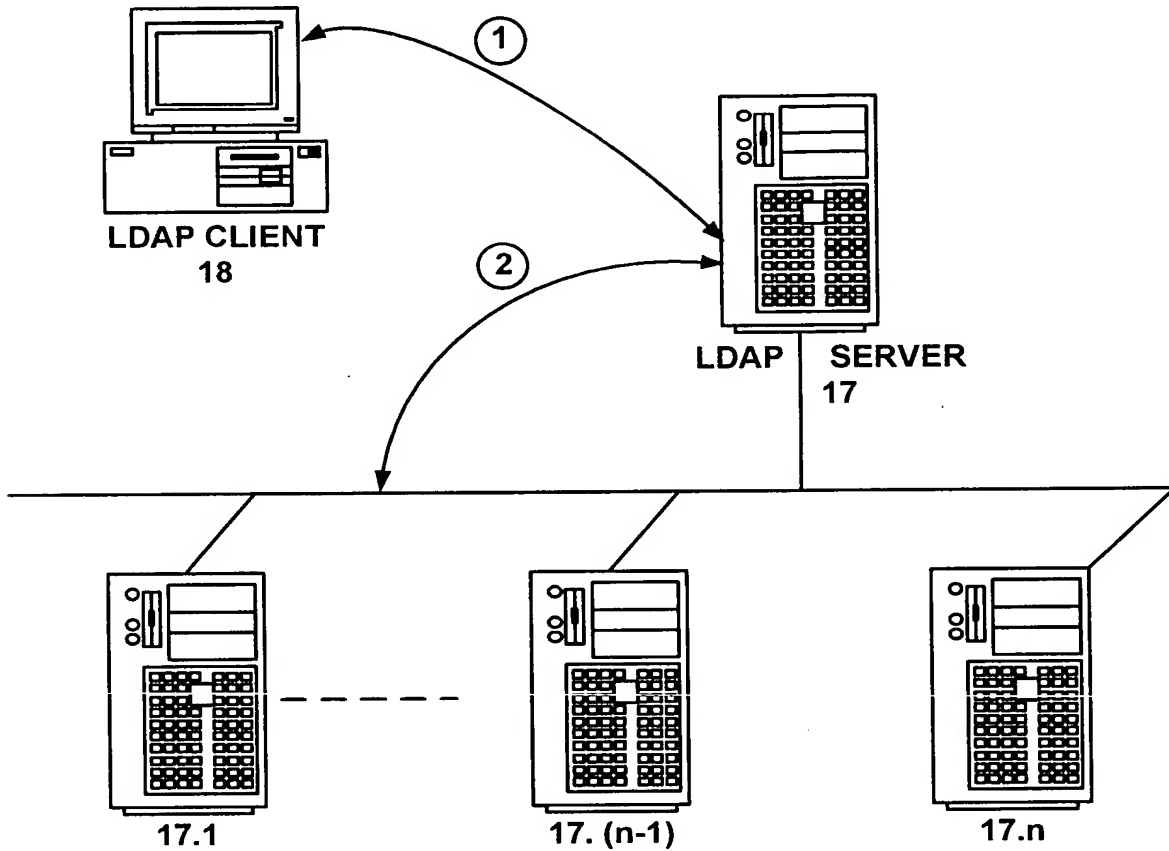**FIGURE 4**

TITLE: INDEXING VIRTUAL ATTRIBUTES IN A DIRECTORY SERVER SYSTEM
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ENTRY
404

ATTRIBUTE TYPE
400

ATTRIBUTE VALUE
402

dn :	uid=Joe, ou=people, dc=france, dc=sun, dc=com
objectClass :	top
objectClass :	person
objectClass :	organizationlPerson
objectClass :	inetOrgPerson
cn :	Joe
sn :	Rayan
uid :	joerayan
mail :	joerayan@sun.com
phoneNumber :	778

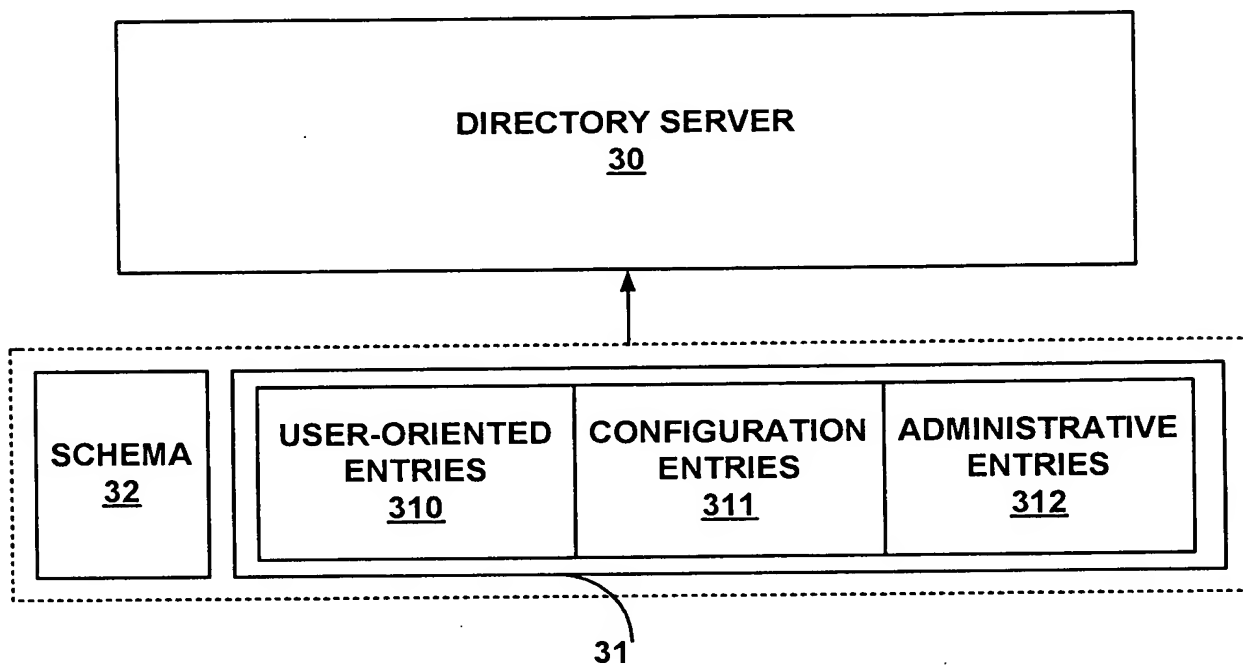# FIGURE 5
(PRIOR ART)

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SEARCH RESULTS
100

THE "BARE DN" SPECIFIED IN THE REQUEST MATCHES A SUFFIX CONTAINED IN AT LEAST ONE DATABASE?
102

→ N →

RETURN AN ERROR MESSAGE
103

BREAK DOWN THE SEARCH FILTER INTO ELEMENTARY SEARCH FILTERS
104

FOR EACH ELEMENTARY SEARCH FILTER

GENERATE A CANDIDATE LIST THAT INCLUDES ALL ENTRIES IN THE DATABASE
108

← N ←

THE ATTRIBUTE ASSOCIATED WITH THE ELEMENTARY SEARCH FILTER HAS AN INDEX?
105

GET THE CANDIDATE ENTRIES IN THE INDEX
106

OTHER ELEMENTARY SEARCH FILTERS?
109

Y →

N ↓

COMBINE THE CANDIDATE ENTRIES OBTAINED FOR THE DOCUMENTARY SEARCH FILTERS
110

FOR EACH CANDIDATE ENTRY

(A)   (B)

FIGURE 6

TITLE: INDEXING VIRTUAL ATTRIBUTES IN A DIRECTORY SERVER SYSTEM
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(A)

ENTRY MATCHES THE
SEARCH FILTER?
112

—N→

LIMIT IS
REACHED?
114

—N→ (B)

Y

ADD THE CANDIDATE
ENTRY TO RESULT
116

Y

DISPLAY RESULT TO
THE CLIENT
118

FIGURE 6 (CONT.)

TITLE: INDEXING VIRTUAL ATTRIBUTES IN A DIRECTORY SERVER SYSTEM
Inventor(s): Karine Excoffier, Robert Byrne and Gilles Bellaton
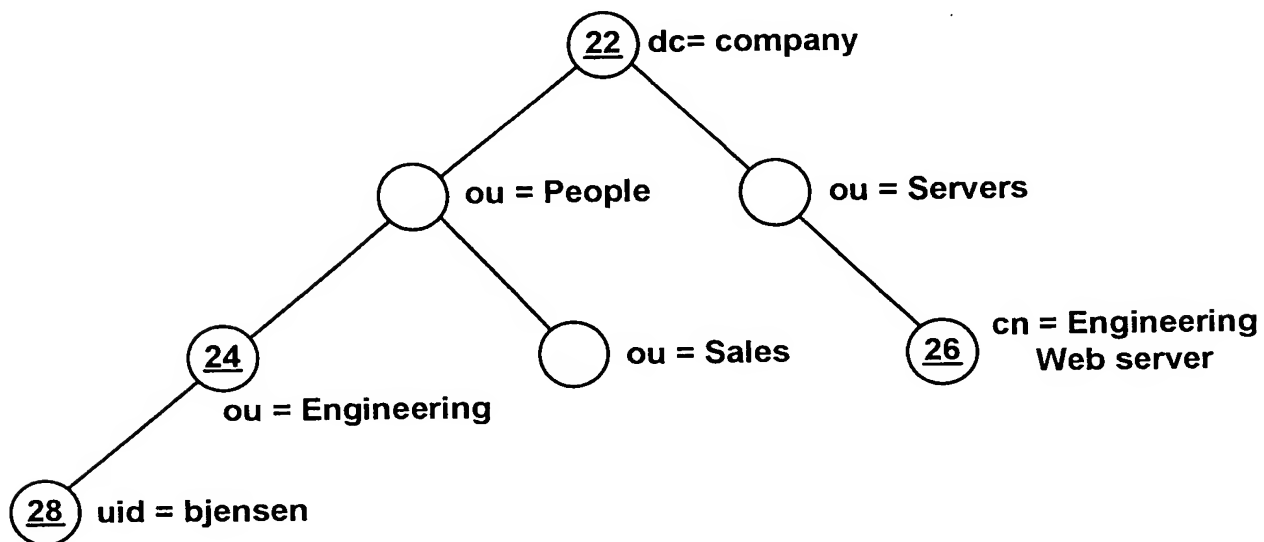USSN: 10/616,081
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FIGURE 7

TITLE: INDEXING VIRTUAL ATTRIBUTES IN A DIRECTORY SERVER SYSTEM
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ROLE TYPE	OBJECT CLASSES 81	ATTRIBUTES 82
MANAGED ROLE 801	nsSimpleRoleDefinition nsManagedRoleDefinition	description (optional)
FILTERED ROLE 802	nsComplexRoleDefinition nsFilteredRoleDefinition	NsRoleDN description (optional)
NESTED ROLE 803	nsComplexRoleDefinition nsNestedRoleDefinition	NsRoleDN description (optional)

FIGURE 8

TITLE: INDEXING VIRTUAL ATTRIBUTES IN A DIRECTORY SERVER SYSTEM
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"LIST OF THE ROLES
POSSESSED BY ENTRY E0"
200

GET THE TOP SUFFIX OF ENTRY E0
202

GET THE ROLE CACHE OF THE TOP
SUFFIX
204

FOR EACH
ROLE

GET THE ROLE DATA OF CURRENT
ROLE
206

E0 IS MEMBER
OF CURRENT
ROLE?
208

Y

N

ADD CURRENT
ROLE TO RESULT
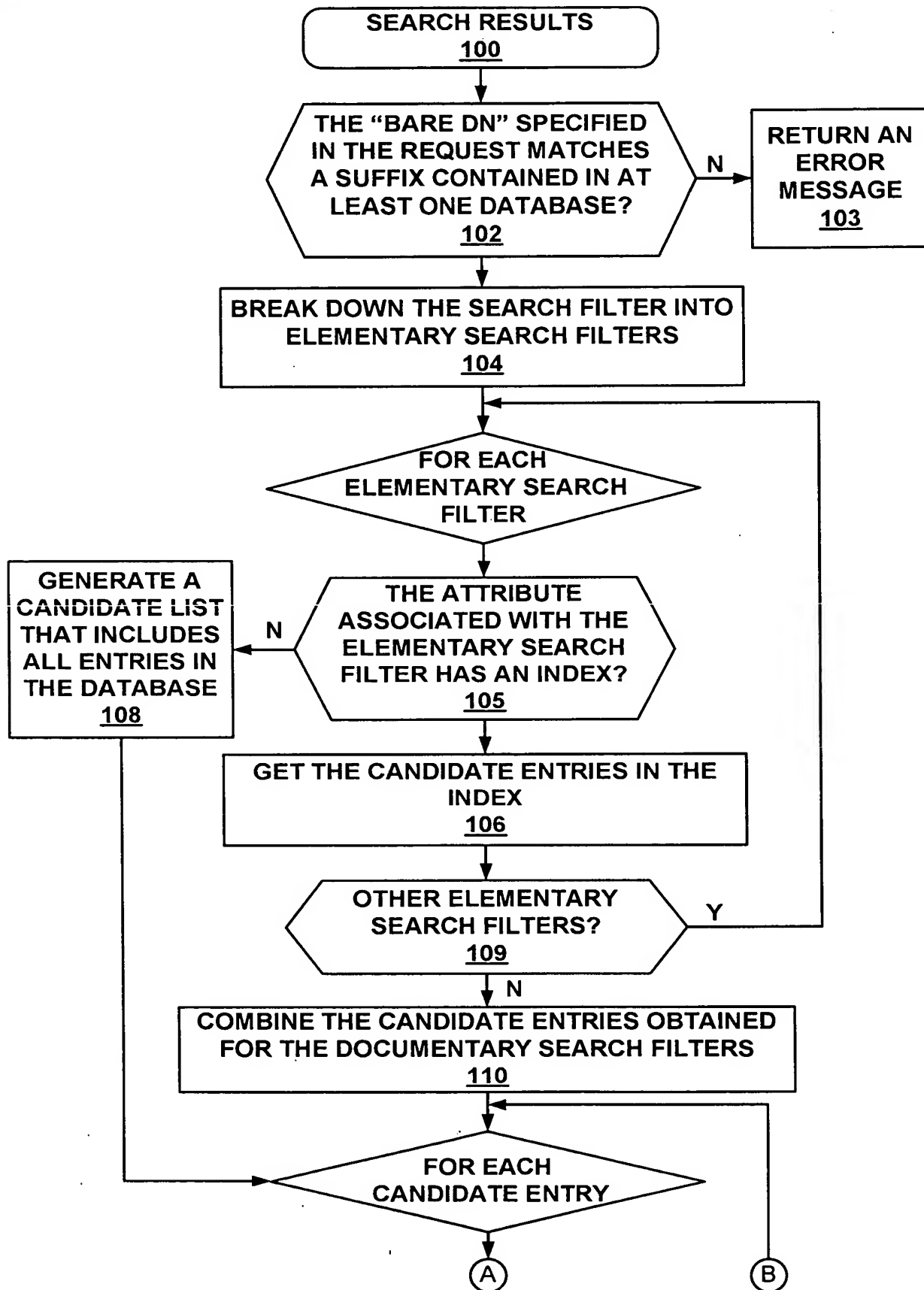209

Y

OTHER
ROLES?
210

N

nsrole = RESULT
212

FIGURE 9A

TITLE: INDEXING VIRTUAL ATTRIBUTES IN A DIRECTORY SERVER SYSTEM
Inventor(s): Karine Excoffier, Robert Byrne and Gilles Bellaton
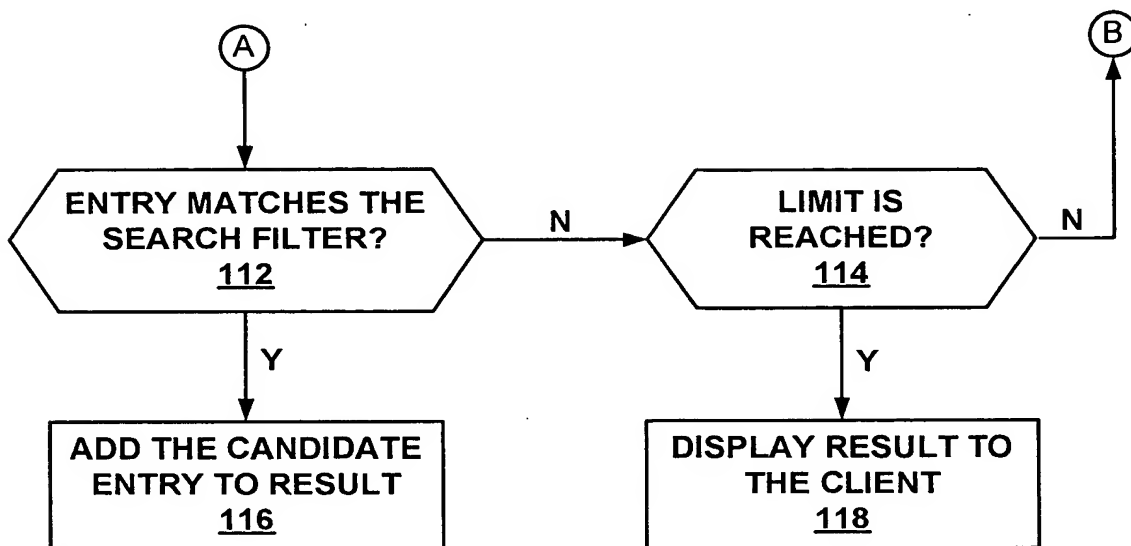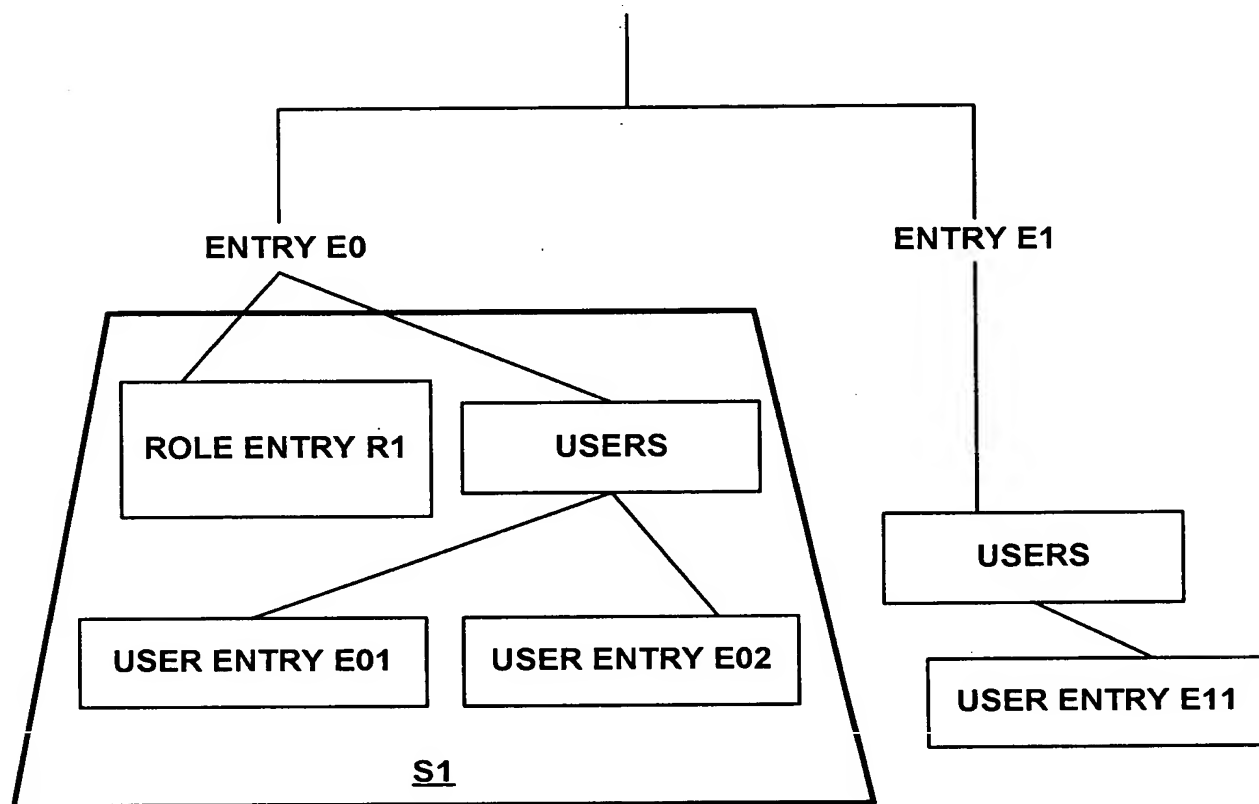USSN: 10/616,081   Attorney D cket #: SUN-P7646

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```
              ┌─────────────────────────┐
              │  ENTRY E0 POSSES ROLE   │
              │          R1?            │
              │           50            │
              └─────────────────────────┘
                          │
                          ▼
              ┌─────────────────────────┐
              │ GET THE ROLE DATA OF ROLE R1 │
              │           51            │
              └─────────────────────────┘
                          │
                          ▼
      N            ┌──────────────────┐
 ◄─────────────────│ E0 IS IN THE SCOPE │
                   │   OF ROLE R1?     │
                   │        52         │
                   └──────────────────┘
                          │ Y
                          ▼
                   ┌──────────────────┐        Y
                   │ ROLE R1 IS NESTED? │──────────────┐
                   │        53          │              │
                   └──────────────────┘               │
                          │ N                          ▼
                          ▼                  ┌────────────────────┐
   ┌──────────────┐  ┌──────────────────┐    │    FOR EACH         │
   │ EO DOES NOT  │◄─│ E0 MATCHES THE    │    │ CONTAINED ROLE,     │
   │ POSSESS ROLE │  │  MEMBERSHIP       │    │  RECURSIVELY        │
   │      R1      │  │ CONDITION OF      │    │   REPEAT            │
   │      58      │  │   ROLE R1?        │    │ OPERATIONS 52       │
   └──────────────┘  │      54           │    │    TO 56            │
                     └──────────────────┘    │      55             │
                          │ Y                └────────────────────┘
                          ▼                             │
                   ┌──────────────┐                     │
                   │ EO POSSESSES │                     │
                   │   ROLE R1    │                     │
                   │      56      │                     │
                   └──────────────┘                     │
                                                        ▼
                 N      ┌──────────────────────────┐   Y
            ◄───────────│ E0 IS MEMBER OF AT        │───────────┐
                        │ LEAST SOME CONTAINED      │           │
                        │        ROLE?              │           │
                        │         57                │           │
                        └──────────────────────────┘           │
                 │                                              │
                 ▼                                              ▼
        ┌──────────────┐                            ┌──────────────┐
        │ EO DOES NOT  │                            │ EO POSSESSES │
        │ POSSESS ROLE │                            │   ROLE R1    │
        │     R1       │                            │      59      │
        │     60       │                            └──────────────┘
        └──────────────┘
```
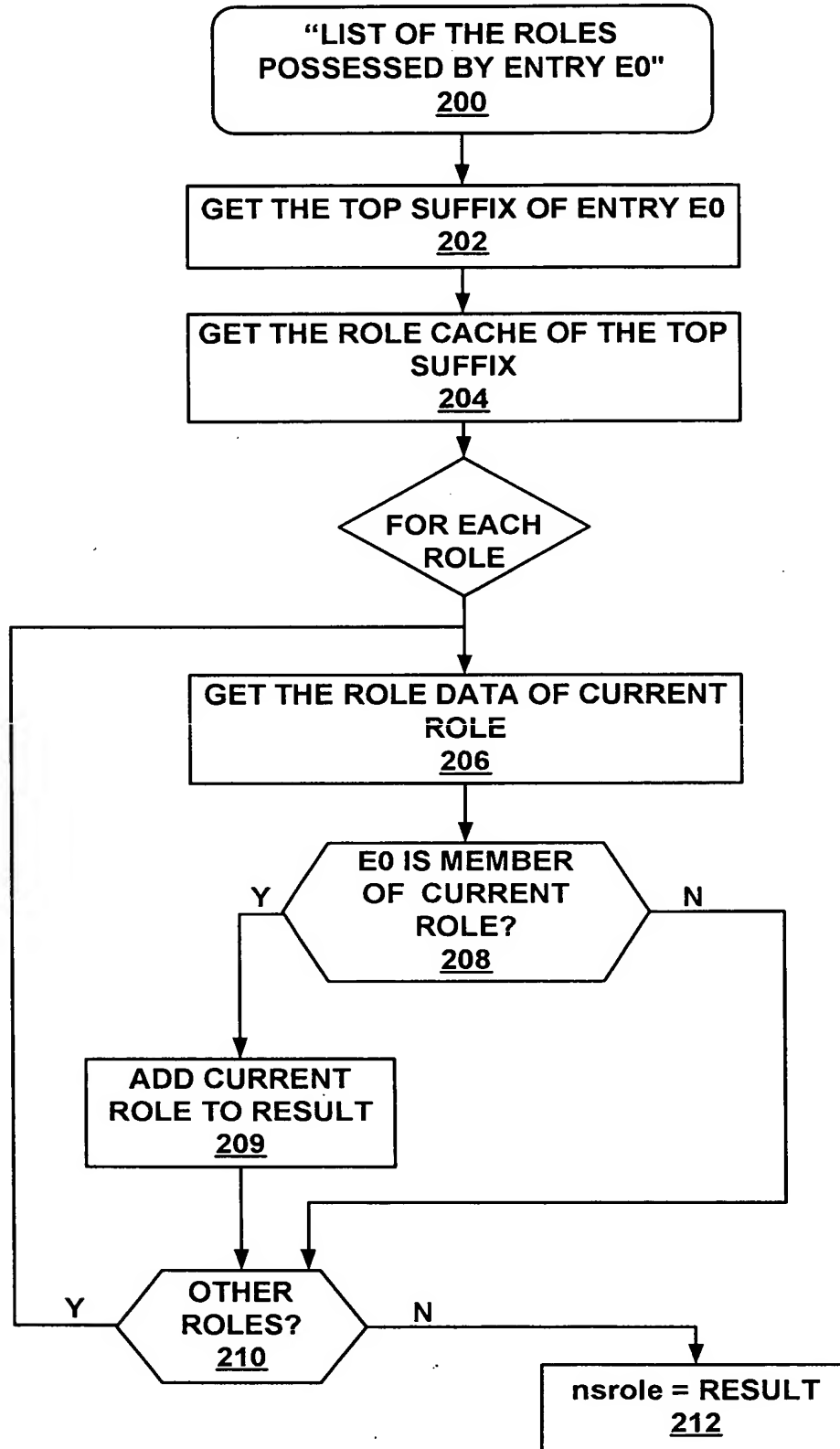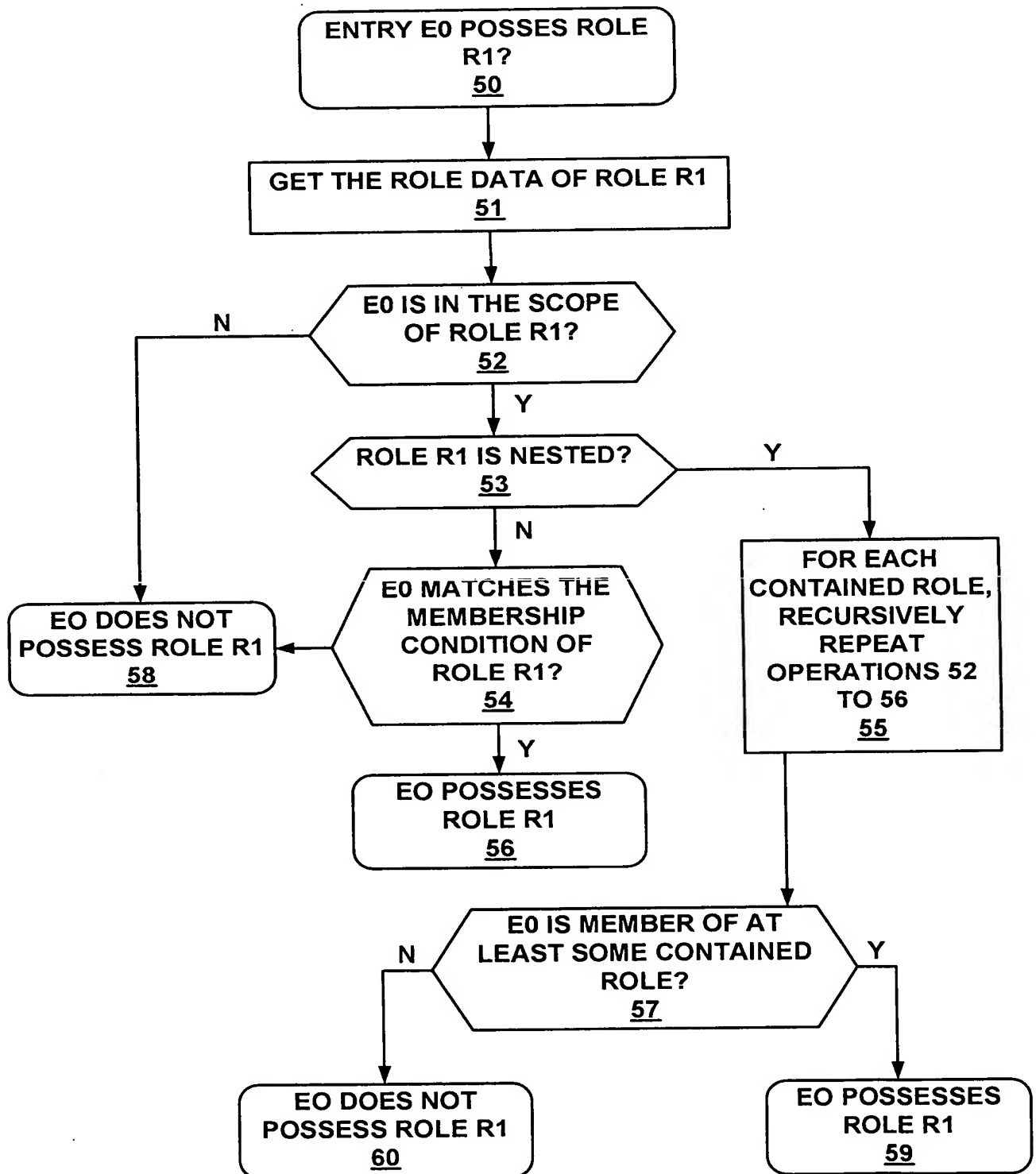
FIGURE 9B

TITLE: INDEXING VIRTUAL ATTRIBUTES IN A DIRECTORY SERVER SYSTEM
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SET OF
ENTRIES

REAL FILTER
EVALUATION
FUNCTION
49

FILTER
DIVIDING
FUNCTION
40

VIRTUAL FILTER
EVALUATION
FUNCTION
44

RESOLVING
FUNCTION
46

DISCRIMINATOR
42

FILTER
DIVIDING
FUNCTION
40

FILTER
EXPRESSION

4

FIGURE 10A

TITLE: INDEXING VIRTUAL ATTRIBUTES IN A DIRECTORY SERVER SYSTEM
Inventor(s): Karine Excoffi r, Robert Byrne and Gilles Bellaton
USSN: 10/616,081   Attorney Docket #: SUN-P7646
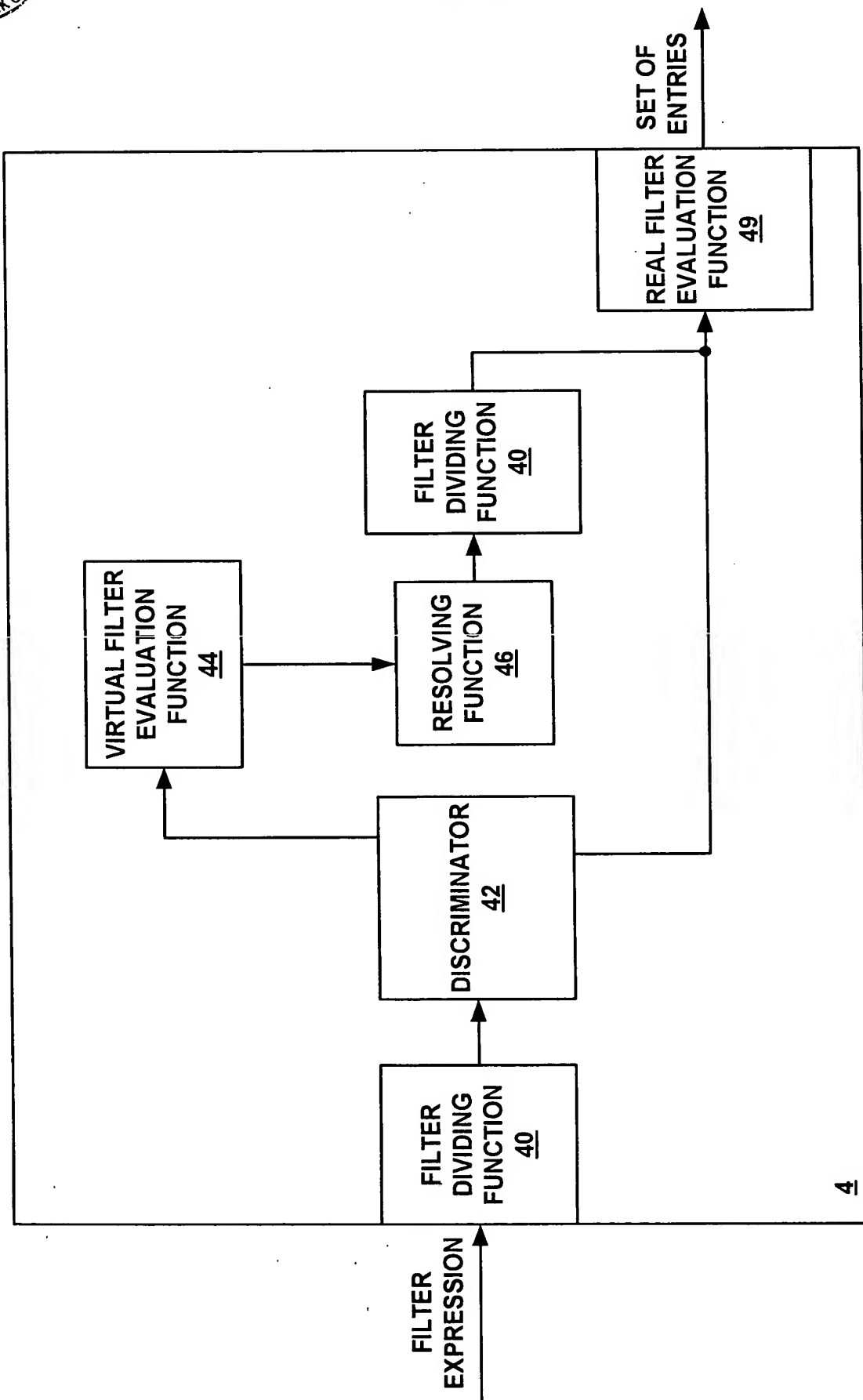
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THE ATTRIBUTE ASSOCIATED WITH
THE ELEMENTARY SEARCH FILTER
HAS AN INDEX?
108

N

STEP 108 ◄——N—— ATTRIBUTE = nsRole?
500

Y

GET THE TYPE OF THE ROLE
IDENTIFIED BY <roledn>
502

TYPE = MANAGED | TYPE = FILTERED | TYPE = NESTED

CONVERT
(nsRole = <roledn>)
INTO
(nsRoleDN = <roledn>)
504

CONVERT
(nsRole = <roledn>)
INTO
(roledn.nsRoleFilter)
506

RECURSIVELY
REPEAT OPERATIONS
FROM OPERATION
502, FOR EACH
CONTAINED ROLE
508

FORM THE UNION OF
THE REAL SEARCH
FILTERS OBTAINED
FOR CONTAINED
ROLES
510

EVALUATE THE REAL SEARCH FILTER
AT STEP 104 (FIGURE 6)
512

APPLY THE VIRTUAL SEARCH FILTER
(nsRole = <roledn>) IN THE
ENTRIES PROVIDED BY STEP 512
514

DISPLAY THE RESULT
TO THE CLIENT

FIGURE 10B

TITLE: INDEXING VIRTUAL ATTRIBUTES IN A DIRECTORY SERVER SYSTEM
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USSN: 10/616,081   Attorn y Docket #: SUN-P7646
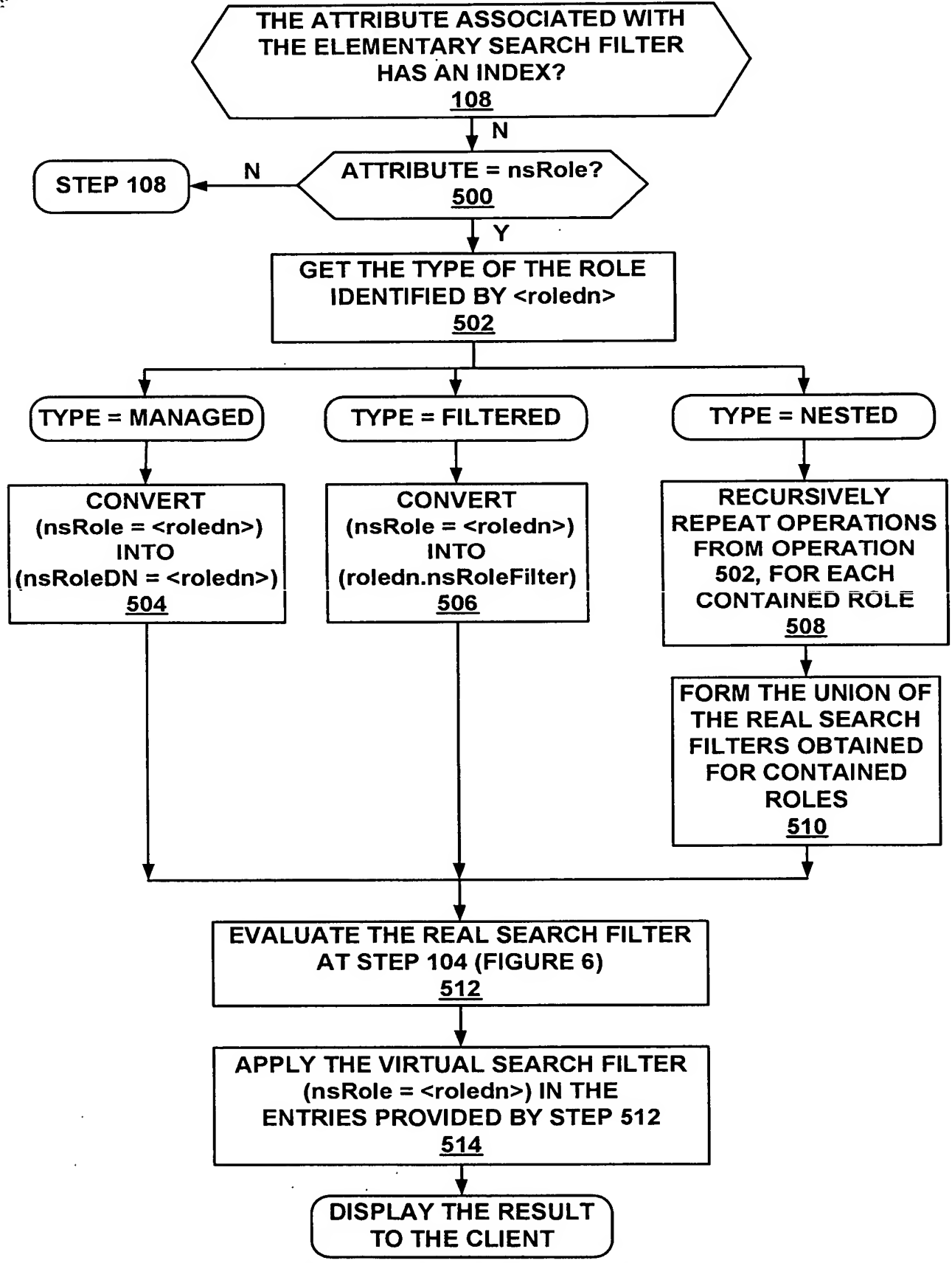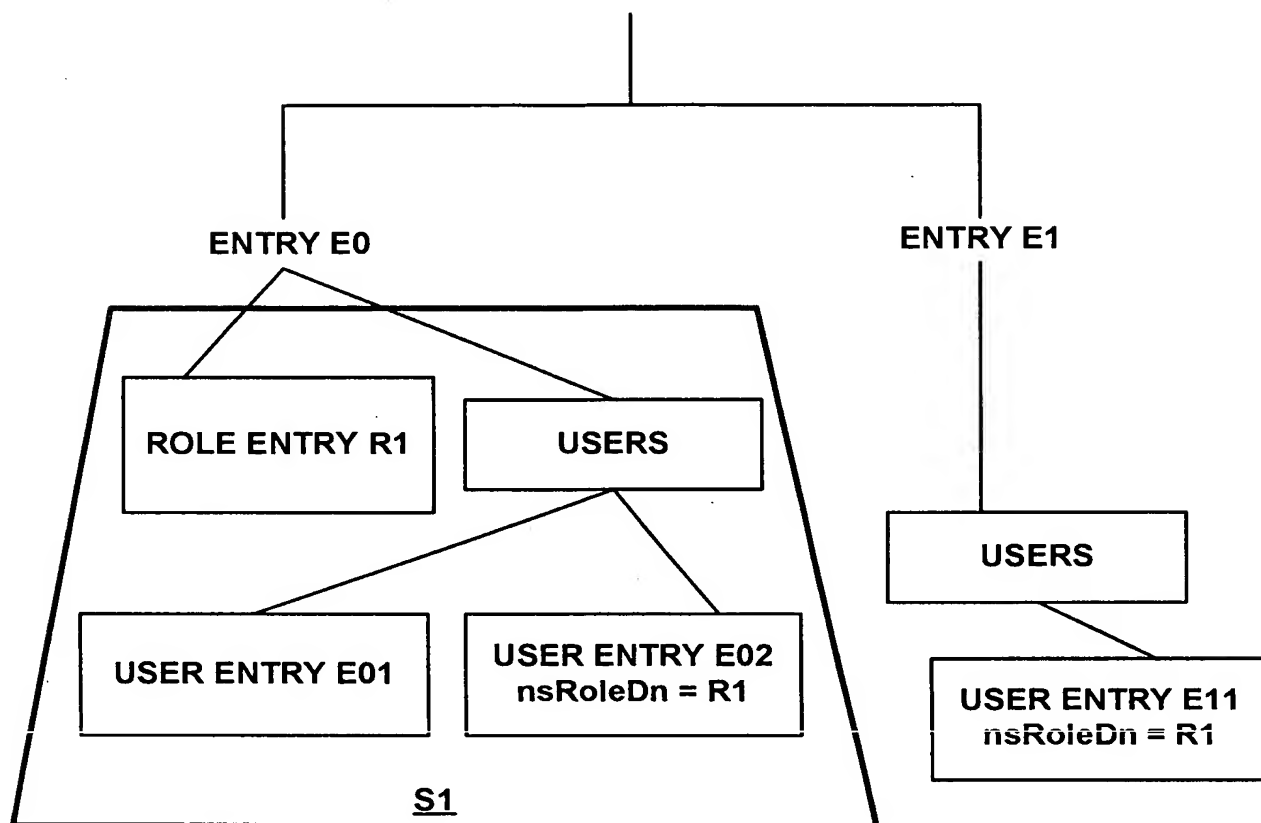
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FIGURE 11